**Fig. 7.4** *A rigid body rotation about the z-axis (Each point of the body such as $P_1$ or $P_2$ describes a circle with its centre ($C_1$ or $C_2$) on the axis of rotation. The radius of the circle ($r_1$ or $r_2$) is the perpendicular distance of the point ($P_1$ or $P_2$) from the axis. A point on the axis like $P_3$ remains stationary).*

**every particle of the body moves in a circle, which lies in a plane perpendicular to the axis and has its centre on the axis**. Fig. 7.4 shows the rotational motion of a rigid body about a fixed axis (the z-axis of the frame of reference). Let $P_1$ be a particle of the rigid body, arbitrarily chosen and at a distance $r_1$ from fixed axis. The particle $P_1$ describes a circle of radius $r_1$ with its centre $C_1$ on the fixed axis. The circle lies in a plane perpendicular to the axis. The figure also shows another particle $P_2$ of the rigid body, $P_2$ is at a distance $r_2$ from the fixed axis. The particle $P_2$ moves in a circle of radius $r_2$ and with centre $C_2$ on the axis. This circle, too, lies in a plane perpendicular to the axis. Note that the circles described by $P_1$ and $P_2$ may lie in different planes; both these planes, however, are perpendicular to the fixed axis. For any particle on the axis like $P_3$, $r = 0$. Any such particle remains stationary while the body rotates. This is expected since the axis of rotation is fixed.

*In case of pure rotational motion the axis of rotation is fixed. In this case for the particle on axis of rotation. $r = 0$ and $v = 0$.*
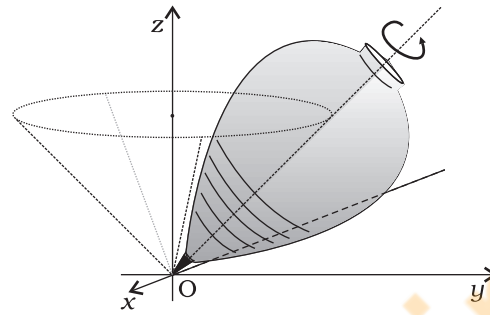


**Fig. 7.5 (a)** *A spinning top (The point of contact of the top with the ground, its tip O, is fixed.)*
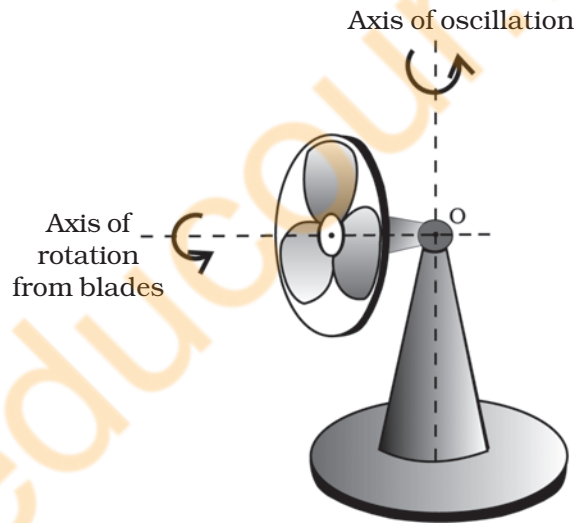


**Fig. 7.5 (b)** *An oscillating table fan with rotating blades. The pivot of the fan, point O, is fixed. The blades of the fan are under rotational motion, whereas, the axis of rotation of the fan blades is oscillating.*

In some examples of rotation, however, the axis may not be fixed. A prominent example of this kind of rotation is a top spinning in place [Fig. 7.5(a)]. (We assume that the top does not slip from place to place and so does not have translational motion.) We know from experience that the axis of such a spinning top moves around the vertical through its point of contact with the ground, sweeping out a cone as shown in Fig. 7.5(a). (This movement of the axis of the top around the vertical is termed **precession**.) Note, the **point of contact of the top with ground is fixed**. The axis of rotation of the top at any instant passes through the point of contact. Another simple example of this kind of rotation is the oscillating table fan or a pedestal fan [Fig.7.5(b)]. You may have observed that the

*\* Motion of spinning top is called 'precession'. In this case the axis of rotation moves such that it sweeps out a cone. (see fig 7·5a)*